

REMARKS

This is a full and timely response to the Office Action mailed July 17, 2008, submitted concurrently with a one month extension of time to extend the due date for response to November 17, 2008.

By this Amendment, claims 3 and 56 have been amended to put the claims in better form under U.S. practice and to address the objection under 37 CFR 1.75(c). Thus, claims 1-53, 55 and 56 are currently pending in this application. Support for the claim amendments can be readily found variously throughout the specification and the original claims.

In view of these amendments, Applicant believes that all pending claims are in condition for allowance. Reexamination and reconsideration in light of the above amendments and the following remarks is respectfully requested.

Objection under 37 CFR 1.75(c)

Claim 56 is objected to under 37 CFR 1.75(c) for allegedly failing to further limit the subject matter of a previous claim. Applicant notes that the preamble of claim 56 was inadvertently drafted to be directed to a method for severing a brittle material substrate instead of a severing apparatus for a brittle material substrate. Applicant believes that the foregoing amendment to claim 56 overcome the outstanding objection by amending the preamble of claim 56 to be consistent with the preamble of claim 28 from which it depends. Thus, in view of the amendment to claim 56, withdrawal of the outstanding objection is respectfully requested.

Rejections under 35 U.S.C. §112

Claim 3 is rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. Applicant respectfully traverses this rejection.

Based on Applicant's review of the specification and rejected claim, Applicant has amended claim 3 to recite "*wherein the brittle material substrate is a ~~single plate~~ single-plated brittle material substrate*". Also, in combination with the amendment, Applicant wishes to explain to the Examiner that the term "*single-plated*" describes one possible structure of the substrate. As stated in the specification, the claimed method can use a brittle material substrate in the structure of

a single-plate (see Figure 1 of the present patent application publication US 2005/0245051) or the structure of a first substrate bonded together with a second substrate (see claim 3 versus claim 12 of the present claims, and paragraph [0003] of the present patent application publication). Hence, Applicant believes that the term "*single-plated*" does further limit the structure of the brittle material substrate to a single-plate as opposed to the structure of a first substrate bonded together with a second substrate.

Thus, in view of the above and the amendment to claim 3, withdrawal of this rejection is respectfully requested.

Claims 6 and 21 are rejected under 35 U.S.C. §112, first paragraph, as allegedly failing to comply with the enablement requirement. Applicant respectfully traverses this rejection.

The Examiner has rejected claims 6 and 21 since the Examiner believes that the protective material formed on the wheel and brittle material, and cutting of the protective material after scribing are mutually exclusive since in order for the protective material to be on the wheel it must have performed a scribing step. However, based on Applicant's review of the rejected claims, specification and the Examiner comments, Applicant respectfully submits that the Examiner has not fully understood the present invention.

Applicant believes that the protective material on the wheel and brittle material, and cutting the protective material after scribing are not mutually exclusive since it is possible in the present invention to perform a scribing step with the cutter wheel on the protective material and afterwards, cut the protective material after scribing (see Figures 1(a) to 1(d) of the present drawings).

Thus, for these reasons, withdrawal of this rejection is respectfully requested.

Rejections under 35 U.S.C. §103

Claims 1-4, 19, 20, 22, 23, 25-34, 36, 46-50, 52, 53, 55 and 56 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Jin et al. (U.S. Patent No. 6,121,118) in combination with Siniaguine et al. (U.S. Patent Application Publication No. 2001/0001215), Yamamichi (JP 56-067933) and Hasegawa et al. (U.S. Patent No. 6,461,940). Further, claims 12-15

and 39-41 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Jin et al. (U.S. Patent No. 6,121,118), Siniaguine et al. (U.S. Patent Application Publication No. 2001/0001215), Yamamichi (JP 56-067933) and Hasegawa et al. (U.S. Patent No. 6,461,940) and further in combination with Ball (U.S. Patent Application Publication No. 2002/0031864). Applicant respectfully traverses these rejections.

To establish a *prima facie* case of obviousness, the cited references, in combination, must teach or suggest the invention as a whole, including all the limitations of the claims. Here, in this case, Jin et al., in combination with Siniaguine et al., Yamamichi, Hasegawa et al., and Ball, fails to teach or suggest all the claim limitations with particular emphasis on the limitation "*wherein the method comprises a first scribing step of pressing and rolling the cutter wheel on a protective material by moving the tip holder in a horizontal direction, in a state in which the protective material is provided on at least one substrate surface of the brittle material substrate, thereby inscribing a scribe line on the brittle material substrate, while simultaneously forming a vertical crack extending from the scribe line in a thickness direction of the brittle material substrate, and wherein the apparatus comprises a first scribing device that presses and rolls the cutter wheel on a protective material by moving the tip holder in a horizontal direction, in a state in which the protective material is provided on at least one substrate surface of the brittle material substrate, thereby inscribing a scribe line on the brittle material substrate, while simultaneously forming a vertical crack extending from the scribe line in a thickness direction of the brittle material substrate*".

The cited references of Jin et al., Siniaguine et al., Yamamichi, Ball, and in particular, Hasegawa et al., in the Office Action disclose a saw blade or a dicing blade being rotary driven (*mechanism to rotate the saw blade or dicing blade at high speed*) for cutting or grinding a substrate, thereby forming the scribe line (groove) having a width (see, for example, column 3, lines 38-39, of Hasegawa et al.). Due to the rotating mechanism of the rotary drive, the "rotating" saw blade or the dicing blade of the cited references is capable of simultaneously cutting or grinding both the protective coating and the substrate for forming the scribe line when the protective coating is formed on a substrate surface. For example, Yamamichi discloses cutting by blade 4, a

semiconductor wafer on which a photoresist coating and an aluminum coating are formed on the surface for forming the scribe groove.

In contrast to the cited references, the cutter wheel of the present invention is not rotary driven, but instead, is rotatably supported, which means that the cutter wheel is rolled on the substrate surface by friction force while the cutter wheel is pressed and moved on the substrate. As the cutter wheel is rolled and pressed on the substrate surface, and as a trace that it is pressed on the substrate surface, the scribe line (marking line) is formed while simultaneously forming a vertical crack extending from the scribe line in a thickness direction of the substrate.

Applicant wishes to note that the term "*scribe*" can be construed as meaning both a grooving process by cutting or grinding as in the cited references and a crack forming process by rolling and pressing as in the present invention. Applicant also notes that the scribing method of rolling and pressing the cutter wheel on the substrate for forming the crack as in the present invention is also called "*scoring*" which is distinguishable from the method of the cited references.

It is important to emphasize the cutting and grinding by a rotary driven saw blade or a dicing blade is clearly distinguishable from the rolling and pressing by the cutter wheel of the present invention. In the Merriam-Webster Online Dictionary, the term "rolling" is defined as "to move along a surface by rotation without sliding" which is clearly not equivalent in meaning to the terms "*cutting*" and "*grinding*" of the cited references.

In support, Applicant wishes to note that in the scribing method of the present invention of pressing and rolling the cutter wheel on the substrate for forming the crack, the pressing force is substantially reduced, which causes the failure to form the crack, if the cutter wheel fails to rotate due to, for example, the blade-edge being worn or the rotate support shaft being locked.

The present invention addresses the problem of when the protective coating is formed on the substrate surface, the cutter wheel tends to slide which causes the cutter wheel to not roll on the surface of the protective coating. This, in turn, causes the pressing force of the cutter wheel to be reduced thereby making it difficult to form the vertical crack. The present invention solves this "*sliding problem*" by using a cutter wheel with grooves formed in the blade-edge ridge thereof which allows the blade-edge to more firmly fix onto the protective coating or the substrate and allows the cutter wheel to roll (due to a stronger friction force) on the surface of the protective

coating. As a result, the pressing force of the cutter wheel is effectively maintained to cause the formation of the vertical crack.

In contrast, since, in the cited references, the saw blade or dicing blade cuts or grinds the substrate by the high speed rotation of the rotary driven blade, there is no "*sliding problem*" which needs to be solved. In support, Applicant wishes to direct the Examiner's attention to Hasegawa et al. which the Examiner has cited as teachings a ring-shaped blade with grooves on the edge that corresponds to the cutter wheel of the present invention.

The blade disclosed in Hasegawa et al. is different from the grooved cutter wheel of the present invention. The blade used in Hasegawa et al. has a different purpose and design than the cutter wheel of the present invention. The purpose of Hasegawa et al.'s blade is to remove the cutting debris from the blade to the top surface of the wafer (*caused by the cutting and grinding action of the blade*). The debris dulls the blade and prevents effective scribing of the wafer. Hasegawa et al. teaches that only the specific design of the grooves on the edge of the ring-shaped blade can be effective in removing the debris from the blade to the top surface of the wafer (see column 5, Table 1, of Hasegawa et al.)

In contrast, as noted above, the "*grooved*" edge design of the cutter wheel of the present invention is important because the cutter edge is in contact with the protective film. Without the grooves, the cutter wheel will slide, thus making it difficult to form the scribe line (see paragraph [0057] of the present patent publication). In addition, the pressing force of the cutter wheel is concentrated on the contact point between the cutter wheel and the substrate since intermittent shocks are applied, thus making it easy to form a scribe line. Such an effect would not be possible with the blade design of Hasegawa et al. which only teaches one to four slits on the edge of the blade varying in width and length.

Hence, Applicant believes that the cutter wheel of the present invention is clearly different from the saw blade or the dicing blade described in the cited references. Thus, for the reasons noted above, withdrawal of the present rejections is respectfully requested.

CONCLUSION

For the foregoing reasons, all the claims now pending in the present application are believed to be clearly patentable over the outstanding rejections. Accordingly, favorable reconsideration of the claims in light of the above remarks is courteously solicited. If the Examiner has any comments or suggestions that could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the below-listed number.

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Respectfully submitted,

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